Functional activity and connectivity during creative ideation in product design engineers

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Abstract

Product Design Engineering (PDE) ideation, the generation of ideas for functional products to address a given problem, is a complex creative behaviour with substantial technological and societal impact. While researchers have begun to examine the neural basis of PDE ideation, firm conclusions as to the cortical regions underlying this behaviour have yet to be made. Furthermore, no study has investigated which neural regions, if any, functionally interact during ideation. In the study 30 professional product design engineers were tasked with generating novel and feasible ideas for products in response to design briefs while undergoing fMRI. Contrasts between ideation and 3 control tasks (rest, 2-back and mental rotation) showed consistent activations in the left PFC including the middle, superior and inferior frontal gyrus. Significant left parahippocampal gyrus activity was also shown during ideation when compared with 2-back and rotation. Finally, PPI analysis revealed higher functional connectivity between the middle and superior frontal gyrus during ideation as compared with rest. The results align with previous studies highlighting the role of the left PFC in ideation, suggesting that the

generation of novel and feasible design ideas involves top-down executive processes such as inhibition and response monitoring. The observed left parahippocampal activations also indicate a role for episodic memory processing during ideation such as the retrieval of information from previously encountered design problems. Finally, this is the first study to examine functional connectivity in a PDE context, showing that key regions of the left PFC also interact to support ideation.

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Fingerprint

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